Optical unit for a motor vehicle.

FIELD OF THE INVENTION

The present invention relates to a front unit for a motor vehicle, of the type comprising:

- at least one optical unit which comprises a casing provided with inlet and outlet openings for a flow of air sweeping the inside of the casing,
- a heat exchanger, and
- a fan for producing an airstream passing through the heat exchanger.

BACKGROUND TO THE INVENTION

In such a front unit, the flow of air sweeping the casing of each optical unit enables the condensates present therein to be removed and also enables the atmosphere inside the casing to be cooled.

Generally, the circulation of the air flow is ensured by natural convection.

In that case, the time necessary to remove the condensates may be too long, so that the condensates present on the glass of the casing impair the operation of the optical unit and its aesthetic quality.

In order to solve that problem, document FR-2 779 804 has proposed the arrangement of a fan in the casing of each optical unit. Such a fan creates a forced flow of air between the inlet opening and the outlet opening

each optical unit. Such a fan creates a forced flow of air between the inlet opening and the outlet opening of the casing, thus enabling the time taken to remove the condensates to be reduced.

However, that solution is found to be expensive since it makes it necessary to equip each optical unit with a fan. In addition, its implementation poses numerous problems, especially owing to the electrical interference to which the electrical motors of the fans may be subjected, problems involved in the electrical connection of the motors etc.

An object of the invention is therefore to improve in a simple and economical manner the removal of condensates in the optical unit or units of a front unit of the above-mentioned type.

SUMMARY OF THE INVENTION

To that end, the invention relates to a front unit of the above-mentioned type, characterized in that the front unit comprises a duct, a first end of which is connected to an opening in the casing of the optical unit and a second end of which is arranged in the vicinity of the fan so that the fan produces the flow of air for sweeping the inside of the casing.

According to particular embodiments, the front unit may comprise one or more of the following features, taken in isolation or according to any technically possible combination:

- it comprises a shroud for channelling the airstream between the fan and the heat exchanger, the second end of the duct being connected to the shroud;
- it comprises a Venturi device which is arranged in the vicinity of the fan and which comprises a divergent main passage and an auxiliary passage connecting the main passage and the second end of the duct;
- the shroud forms the main passage of the Venturi device;
- the main passage diverges in the direction of circulation of the airstream in order to bring about the suction, by way of the second end of the duct, of the flow of air for sweeping the inside of the casing;
- the fan is to be located behind the heat exchanger when the front unit is mounted on the motor vehicle;
- the fan is to be located in front of the heat exchanger when the front unit is mounted on the motor vehicle.

The invention relates also to a motor vehicle, characterized in that it comprises a front unit as defined above.

BRIEF DESCRIPTION OF DRAWINGS

The invention will be better understood on reading the following description which is given purely by way of example and with reference to the appended drawings in which:

- Figure 1 is a diagrammatic side view of a front unit of a motor vehicle according to a first embodiment of the invention,

- Figure 2 is an enlarged and sectional diagrammatic view of an optical unit of the front unit of Figure 1, taken on the line II-II,

- Figures 3 and 4 are sectional and diagrammatic upper half-views of the heat exchanger and the fan of the front unit of Figure 1, illustrating, respectively, the case where the fan is in operation and the vehicle is at a standstill and the case where the fan is not in operation and the vehicle is moving,

- Figures 5 and 6 are views analogous to Figures 3 and 4, illustrating a variant of the embodiment of Figures 1 to 4,

- Figures 7 and 8 are views analogous to Figures 3 and 4, illustrating a second embodiment of the invention, and

- Figures 9 and 10 are views analogous to Figures 3 and 4, illustrating a variant of the second embodiment of the invention.

DESCRIPTION OF PREFERRED EMBODIMENTS

Throughout the following, the orientations used are the normal orientations of a motor vehicle.

In particular, the terms "front", "rear", "right" and "left" are to be understood relative to the position of a driver and to the direction of travel of the motor vehicle.

Figure 1 illustrates a front unit 1 of a motor vehicle which comprises, in particular, two lateral optical units 2 arranged one on each side of the motor vehicle, a radiator 3 for cooling the heat engine of the motor vehicle, and a fan 4 comprising an impeller 5 and an electrical motor 6 for driving the impeller in rotation.

Owing to the fact that the front unit 1 is symmetrical relative to a longitudinal, vertical and median plane, only the structures of the left-hand portion of the front unit 1 and of its left-hand optical unit 2 will be described hereinafter.

The optical unit 2 is a conventional optical unit comprising a casing 7 formed by an opaque rearward back portion 8 and a transparent front glass 9 closing the back portion 8. The optical unit 2 comprises, inside the casing 7, a projector 10 comprising at least one lamp (not shown) and a reflector 11.

The back portion 8 of the casing 7 may be formed in one piece with a front face supporting the optical unit 2, the radiator 3 and the fan 4. It may also be, in a conventional manner, an element which is separate from the front face.

The back portion 8 of the casing 7 is provided with a first opening 12 formed in its lower wall and a second opening 13 (Figure 2) formed in its rear wall. The openings 12 and 13 are spaced laterally from one another, the opening 12 being arranged laterally towards the inside of the vehicle and the opening 13

being arranged laterally towards the outside of the vehicle, as illustrated by Figure 2. The opening 13 has baffles.

The fan 4 is arranged behind the radiator 3 to produce, by suction, a stream of air passing through the radiator 3. The front unit 1 comprises a shroud 14, sometimes called a duct, which extends between the radiator 3 and the impeller 5 of the fan 4 in order to channel the airstream created by the fan 4. The shroud 14 is produced, for example, by moulding a plastics material.

The front unit 1 also comprises a duct 15, for example in the form of a flexible tube. A first end 16 of the duct 15 is connected to the first opening 12 of the casing 7 of the optical unit 2, for example by way of a feed-through sleeve 17 receiving a bundle 18 of electrical conductors connecting the lamps of the optical unit 2 to an electrical power supply which is not shown.

The second end 19 of the duct 15 leads into the shroud 14 between the radiator 3 and the impeller 5, and therefore to the vicinity of the fan 4.

As illustrated by Figure 3, the connection of the end 19 of the duct 15 to the shroud 14 can be effected by way of an air inlet 20 which projects outwards from the shroud 14 and onto which the second end 19 is fitted.

When the motor vehicle is at a standstill and the fan 4 is in operation (Figure 3), the fan produces, by suction, a stream of air symbolised by the arrow 21. The stream passes through the radiator 3 and flows towards the rear.

A partial vacuum is thus created in the space 22 delimited on the inside by the shroud 14 between the radiator 3 and the impeller 5. Since the space 22 is connected by the duct 15 to the casing 7 of the optical unit 2, a forced flow of air towards the space 22 is created in the casing 7. That flow of air streams from the opening 13 towards the opening 12 whilst sweeping the casing 7, then streams into the duct 15 as symbolised by the arrow 23. Thus, the condensates present in the casing 7 are removed towards the outside of the casing 7 by way of the opening 12 and then the duct 15.

As illustrated by Figure 4, when the fan 4 is not in operation and the vehicle is moving, the relative displacement between the vehicle and the outside air produces a stream of air flowing towards the rear and symbolised by the arrow 21.

The stream of air passes through the radiator 3 and is then channelled by the shroud 14 towards the rear. As a result, excess pressure occurs in the space 22. That excess pressure produces in the duct 15 a flow of air which is symbolised by the arrow 23 and which circulates towards the casing 7. The flow sweeps the inside of the casing 7 from the opening 12 towards the opening 13. The condensates present inside the casing

7 are then removed towards the outside of the casing 7.

In each of those cases, the flow rate of the forced flow of air sweeping the inside of the casing 7 is relatively high, so that the time taken to remove the condensates is relatively short.

In addition, this result is achieved using the fan 4 associated with the radiator 3. Consequently, this solution does not require the integration of new fans in the motor vehicle, and in particular inside the optical units 2. It will therefore be appreciated that this solution is simple and economical to implement.

The presence of the baffles in the opening 13 of the casing 7 enables the ingress of dust and water into the casing 7 to be limited, especially in the case of Figure 3.

In the front unit 1 illustrated by Figures 3 and 4, the fan 4 is in suction configuration. However, the invention can be applied to front units in which the fan 4 is in blowing configuration.

As illustrated by Figures 5 and 6, the fan 4 is then located in front of the radiator 3.

When the fan is in operation and the motor vehicle is at a standstill (Figure 5), the fan 4 produces, by blowing, a stream of air symbolised by the arrow 21 which flows towards the rear, which is channelled by the shroud 14 and which passes through the radiator 3.

Excess pressure is therefore created in the space 22. That excess pressure produces in the duct 15 a flow of air symbolised by the arrow 23. The flow sweeps the inside of the casing 7 from the opening 12 towards the opening 13.

As illustrated by Figure 6, when the motor vehicle is moving and the fan 4 is not in operation, the relative displacement between the vehicle and the outside air produces a stream of air flowing towards the rear and symbolised by the arrow 21. The stream of air passes through the space 22 and then the radiator 3. Excess pressure is created inside the space 22 and brings about the removal of the condensates present inside the casing 7 by blowing, as in the case of Figures 4 and 5.

In contrast to the variant of Figures 1 to 4, the direction of the air flow sweeping the casing 7 is identical in the two cases described in relation to Figures 5 and 6.

Figures 7 and 8 illustrate a second embodiment of the invention, the front unit 1 of which is distinguished from that described in Figures 1 to 4 by the fact that the second end 19 of the duct 15 is connected to the space 22 by way of a Venturi device 29.

The Venturi device 29 comprises a main passage 30 inside the shroud 14 and an auxiliary passage 31, one end of which communicates with the main passage 30 and the other end of which communicates with the end 19 of the duct 15.

The main passage 30 diverges towards the rear. Its upper wall is formed by the outer wall of the shroud 14 and its lower wall is formed by an inner wall of the shroud 14.

The auxiliary passage 31 is a sleeve which projects upwards from the shroud 14 and onto which the end 19 of the duct 15 is fitted.

When the fan 4 is in operation and the vehicle is at a standstill (Figure 7) air circulates towards the rear in the main duct 30, as symbolised by the arrow 32. As a result of the Venturi effect, that circulation produces, in the auxiliary passage 31, suction towards the inner space 22. As symbolised by the arrow 33, the suction brings about a flow of air by way of the duct 15 to the inside of the casing 7, which flow sweeps the casing from the opening 13 towards the opening 12.

When the fan 4 is at a standstill and the vehicle is moving (Figure 8) the Venturi device 29 operates in a similar manner, likewise ensuring the removal of the condensates by suction through the opening 12 in the casing 7 of the optical unit 2.

Figures 9 and 10 illustrate a variant of the second embodiment, in which the fan 4 is in blowing configuration.

When the motor vehicle is at a standstill and the fan 4 is in operation (Figure 9), air circulates in the main passage 30 of the Venturi device 29, as

symbolised by the arrow 32 in Figure 9. In this case too, the circulation produces suction, symbolised by the arrow 33, in the duct 15 which permits removal of the condensates present in the casing 7 by way of the opening 12.

This is also the case when the fan 4 is not in operation and the vehicle is moving (Figure 10).

The Venturi device 29 therefore acts as a pump ensuring that the flow sweeping the casing 7 is effected by suction in the same direction in each of the cases represented in Figures 7 to 10.

Since the opening 12 then used to remove the condensates is located in the lower wall of the casing 7, the removal of the condensates is improved by gravity.

More generally, the above principles may be used in a front unit 1 that does not have a shroud 14, it being necessary for the second end 19 of the duct 15 to be arranged in the vicinity of the fan 4, and preferably between the fan 4 and the radiator 3.

Even more generally, the heat exchanger 3 may be a condenser or the front unit 1 may comprise a radiator and a condenser placed one behind the other, one or other of those two heat exchangers facing the fan 4.